PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : G11B 23/107

A1

(11) International Publication Number: WO 97/15925

(43) International Publication Date: 1 May 1997 (01.05.97)

(21) International Application Number: PCT/US96/16434

(22) International Filing Date: 16 October 1996 (16.10.96)

(30) Priority Data:
08/548,706 26 October 1995 (26.10.95) US

(71) Applicant: IMATION CORP. [US/US]; 1 Imation Place, P.O. Box 64898, Saint Paul, MN 55164-0898 (US).

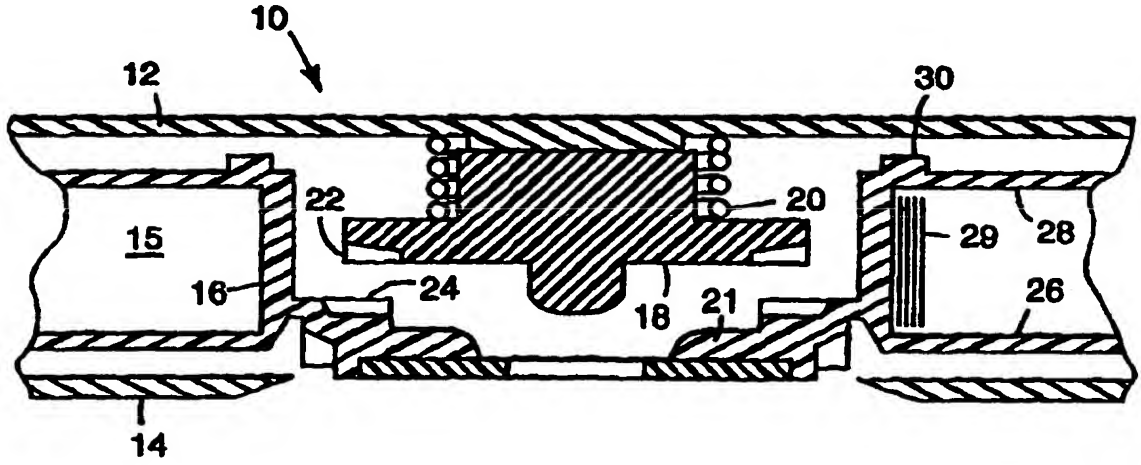
(72) Inventor: MARTIN, Robert, C.; P.O. Box 64898, Saint Paul, MN 55164-0898 (US).

(74) Agent: DENNIS, Charles, L., II; Imation Legal Affairs, P.O. Box 64898, Saint Paul, MN 55164-0898 (US).

(81) Designated States: CN, DE, JP.

Published
With international search report.

(54) Title: STRUCTURE TO LIMIT EDGE CREASING IN A SCATTER-WOUND CARTRIDGE



(57) Abstract

Various structures are described to minimize tape edge creasing in a tape cartridge. Several structures prevent the flange from being pressed by the housing of the tape cartridge into the tape pack with sufficient force to crease the edges of any exposed tape strands. Use of various structures or alternative materials also can stiffen the flange, again reducing the likelihood of the flange deflecting into the tape pack.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AM	Armenia	**GB**	United Kingdom	**MW**	Malawi
AT	Austria	**GE**	Georgia	**MX**	Mexico
AU	Australia	**GN**	Guinea	**NE**	Niger
BB	Barbados	**GR**	Greece	**NL**	Netherlands
BE	Belgium	**HU**	Hungary	**NO**	Norway
BF	Burkina Faso	**IE**	Ireland	**NZ**	New Zealand
BG	Bulgaria	**IT**	Italy	**PL**	Poland
BJ	Benin	**JP**	Japan	**PT**	Portugal
BR	Brazil	**KE**	Kenya	**RO**	Romania
BY	Belarus	**KG**	Kyrgystan	**RU**	Russian Federation
CA	Canada	**KP**	Democratic People's Republic of Korea	**SD**	Sudan
CF	Central African Republic			**SE**	Sweden
CG	Congo	**KR**	Republic of Korea	**SG**	Singapore
CH	Switzerland	**KZ**	Kazakhstan	**SI**	Slovenia
CI	Côte d'Ivoire	**LI**	Liechtenstein	**SK**	Slovakia
CM	Cameroon	**LK**	Sri Lanka	**SN**	Senegal
CN	China	**LR**	Liberia	**SZ**	Swaziland
CS	Czechoslovakia	**LT**	Lithuania	**TD**	Chad
CZ	Czech Republic	**LU**	Luxembourg	**TG**	Togo
DE	Germany	**LV**	Latvia	**TJ**	Tajikistan
DK	Denmark	**MC**	Monaco	**TT**	Trinidad and Tobago
EE	Estonia	**MD**	Republic of Moldova	**UA**	Ukraine
ES	Spain	**MG**	Madagascar	**UG**	Uganda
FI	Finland	**ML**	Mali	**US**	United States of America
FR	France	**MN**	Mongolia	**UZ**	Uzbekistan
GA	Gabon	**MR**	Mauritania	**VN**	Viet Nam

STRUCTURE TO LIMIT EDGE CREASING IN A SCATTER-WOUND CARTRIDGE

Background of the Invention

Field of the Invention

The present invention relates to support mechanisms for tape in a tape cartridge, and in particular, to structures for supporting scatter-wound tape packs.

Description of the Related Art

The tape in many types of tape cartridges winds into a tape pack about the tape spool such that some portions of the tape project above or below the main body of the tape pack. This type of winding is called scatter-wound, as distinct from the smoother winding (with better alignment from one piece of tape to the next) found in some cartridges using belts or the like to assist in packing.

The tape spool in a 3480-style tape cartridge such as that shown in European Published Patent Application 0 588 219 (Martin et al.) is free to float within the cavity created by the base and cover. The only restraint against such motion is the low restraining force of a spring biasing a brake into engagement with the spool. However, during shipping and handling the inertia of the tape pack can easily overcome the force of the brake spring, causing the tape spool to contact the inner walls of the cavity. This contact can force the spool flanges to deflect into the tape pack, thereby creasing the edges of any tape strand which protrudes from the pack. Creases in the tape can result in high error counts on the edge tracks of the tape and the like. Even fairly routine shipping and handling of the cartridge can develop this problem.

This problem is usually most significant for the upper flange because the spool normally is biased toward the bottom of the cartridge

housing. This means that it already is resting flat against the bottom, so any forces tend to be evenly distributed over the entire lower flange. Thus, the lower flange is not likely to be significantly bent or distorted if the cartridge is struck on the bottom. In contrast, the gap between the top of the spool and the cover allows the spool to be thrown against the cover, and, in particular, to be thrown against the cover at varying angles. This means that the outer diameter of the flange may be the only part of the spool contacting the cover. Since the flange is a cantilever beam, a force applied only to the outer diameter deflects the flange much more than a force applied to the inner diameter or the entire flange. This deflection causes the flange to press against the tape pack, potentially creasing the edge of any tape strand(s) projecting above the main body of the tape pack.

Efforts have been made to limit the amount of tape which can protrude from the tape pack by tightly controlling the spacing and taper of the spool flanges. The effectiveness of this approach has been limited by the molding and assembly tolerances encountered during manufacture of the spool and assembly of the drive. As a consequence of this, some past spool designs allow tapes to become creased within the recording part of the tape, thus resulting in high error counts.

Summary of the Invention

The present invention significantly reduces creasing by modifying the tape spool or cover to limit contact between the flange and the cartridge cover. A ring or ridge of material is added to the upper surface of the flange near its inner diameter. If the cartridge is bumped, causing the spool move toward the cover, this ring will define the primary line of contact of the spool with the inner surface of the cover. Preferably, the height of the ring is such that only the ring will contact the cover. However, it is acceptable for the very outer diameter of the flange to also contact,

provided the geometry is such that the outer diameter is not significantly deflected by the contact. As a result, the inner surface of the flange will not be deflected into the tape pack.

The ring or ridge preferably is placed close to the inner diameter of the flange. This provides the maximum transfer of force directly to the spool hub, with the minimum deflection of the flange.

Alternatively, a ring or ridge of material can be added to the cover of the tape cartridge instead of or in addition to the ring on the flange.

According to another embodiment of the invention, the upper flange is made stiffer to resist deflection into the tape pack. One method is to make the flange out of a material with a higher flexural modulus, such as glass reinforced material. Another method is to provide the flange with radial ribs which resist deflection.

As will be apparent, these various embodiments are not mutually exclusive, and can be combined as desired to achieve the desired effect, which is preventing the flange from creasing the tape edges projecting from the main body of the tape pack.

Brief Description of the Drawings

Fig. 1 is a partial cross-section of a cartridge according to a first embodiment of the invention.

Fig. 2 is a partial cross-section of a cartridge according to a second embodiment of the invention.

Fig. 3 is a partial cross-section of a cartridge according to a third embodiment of the invention.

Detailed Description of the Preferred Embodiments

Fig. 1 depicts a cartridge 10 with a cover 12 and a base 14 defining a cavity 15 therebetween in which a tape spool 16 is rotatably mounted. A brake 18 also is positioned in the cavity 15 and is biased by a brake spring

20 toward the spool hub 21. When positioned in a drive, the drive would push the brake 18 away from the spool hub 21 (as shown in the drawing for clarity). When not in a drive, the brake spring 20 would bias the brake teeth 22 into engagement with the spool teeth 24, thereby preventing rotation of the spool 16.

The spool 16 includes a lower flange 26 and an upper flange 28. In use, tape (shown schematically at 29) would be wound around the spool 16 between the lower and upper flanges 26, 28. The spool 16 may be formed as a single piece (as shown in Fig. 1), or, more conveniently, in multiple pieces, as shown, e.g., in European Published Patent Application 0 588 219 (Martin et al.).

According to the current invention, a ring 30 is provided on the upper surface of the upper flange 28 near the center thereof. If the cartridge is dropped or otherwise impacted and the spool 16 is displaced toward the top cover 12, the ring 30 will engage the cover 12. Preferably, the height and radial position of the ring 30 are such that only the ring will contact the cover. However, it is acceptable for the very outer diameter of the upper flange 28 to also contact, provided the geometry is such that the upper flange 28 is not significantly deflected by the contact. The upper flange 28 therefore will not press against the tape pack 29.

A drop test can be useful in determining the appropriate height and radial position for the ring 30. To use this test, the height and radial position of the ring 30 should be such that the cartridge 10 can be dropped from a predetermined height, e.g., about 1.5 m, and still prevent the flange from deflecting into the tape pack with sufficient force to crease the edges of any exposed tape strands.

Fig. 2 depicts a cartridge which is substantially the same as that depicted in Fig. 1 and therefore will not be described in detail. The difference between Fig. 1 and Fig. 2 is the location of the ring 30. In Fig. 2, a ring 30' is positioned on the cover 12' above the central portion of the

spool 16'. This ring 30' will interact with the upper portion of the spool 16' in much the same fashion as the ring 30 to prevent the flange 28' from pressing against the tape pack 29'.

Fig. 3 depicts a third embodiment according to the present invention. Again, most of the elements are substantially the same as those shown in Fig. 1 and will not be described in detail. In the embodiment of Fig. 3, however, instead of a ring 30, a radially extending rib 32 is provided on the upper flange 28". A plurality of these ribs 32 distributed around the spool 16" stiffen the upper flange 28". As a result, this added stiffness will prevent upper flange 28" from pressing against the tape pack 29". Note that the rib 32 is shown on the right side of the drawing and not on the left because the ribs 32 may not necessarily be along the same diameter across the spool 16".

In addition to or instead of using a ring 30, 30' or ribs 32, the upper flange 28 may be formed of a material having a higher flexural modulus. For example, the material could be a glass reinforced material. Such a material currently is used with some regularity in forming the lower flange 26, e.g., as taught in European Published Patent Application 0 588 219 (Martin et al.), so one skilled in the art will be familiar with how to form a flange of such material.

It will be understood by one skilled in the art that any or all of the various embodiments described above could be combined. For example, it would be perfectly possible to have a ring on both the upper cover and the top of the flange, as well as to have both a ring and ribs. The rings 30, 30' and rib 32 also can be molded as part of the upper flange 28, 28', 28", or can be added thereto, as convenient for manufacturing. Finally, any of these could be combined with a stiffer modulus material.

With all of these alternative embodiments and materials, the drop test described in connection with the first embodiment can be used to set a useful guide for the necessary height, position and/or stiffness.

It will be understood that these exemplary embodiments in no way limit the scope of the invention. Other modifications of the invention will be apparent to those skilled in the art in view of the foregoing description. These descriptions are intended to provide specific examples of embodiments which clearly disclose the present invention. Accordingly, the invention is not limited to the described embodiments or to the use of specific elements, dimensions, materials or configurations contained therein. All alternative modifications and variations of the present invention which fall within the spirit and scope of the appended claims are covered.

I Claim:

1. A tape cartridge having:
   a) a housing defining a cavity therein;
   b) a spool having a central hub, and two flanges; and
   c) tape wound on the spool between the flanges to form a tape pack;

characterized in that an abutment structure is formed on at least the housing or one flange, the abutment structure being of a height and radial position such that it does not interfere with operation of the spool in normal use, but if the cartridge is dropped from a predetermined height, the abutment structure will contact the opposing flange or housing to substantially prevent the flange from being deflected by the housing into the tape pack with sufficient force to crease the edge of any tape strands projecting beyond the main body of the tape pack.

2. The tape cartridge of claim 1, further characterized in that the abutment structure comprises a ring.

3. The tape cartridge of claim 2, further characterized in that the ring is formed on a surface of the spool near the center of the flange.

4. The tape cartridge of claims 2 or 3, further characterized in that the ring is formed on an inner surface of the housing adjacent to the central portion of the flange.

5. The tape cartridge of any of claims 1-4, further characterized in that the abutment structure is formed on both the housing and one flange.

6. The tape cartridge of claim 5, further characterized in that the abutment structure on the housing aligns with the abutment structure on the flange.

7. A tape cartridge having:

a) a housing defining a cavity therein;

b) a spool having a central hub and an upper and a lower flange; and

c) tape wound on the spool between the flanges;

characterized in that the upper flange is stiffened by stiffening means enough that if the cartridge is dropped from a predetermined height and the flange contacts the housing, the housing will not deflect the flange into the tape pack with sufficient force to crease the edge of any tape strands projecting beyond the main body of the tape pack.

8. The tape cartridge of any of claims 1-7, further characterized in that the upper flange is stiffened by being formed of materials having a sufficiently high flexural modulus to make the flange sufficiently stiff to prevent the deflection.

9. The tape cartridge of any of claims 1-8, further characterized in that the upper flange is stiffened by forming a plurality of radially extending ribs on an upper surface of the upper flange, the ribs being of a sufficient thickness to stiffen the upper flange sufficiently to prevent the deflection.

10. The tape cartridge of any of claims 1-9, further characterized in that the upper flange is formed of a glass reinforced material.

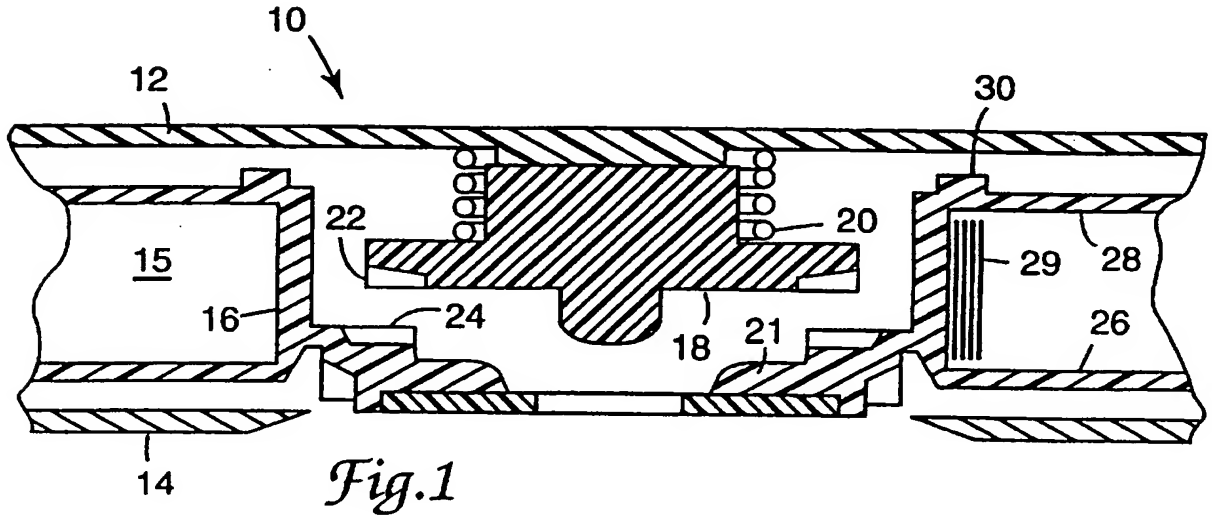


Fig.1

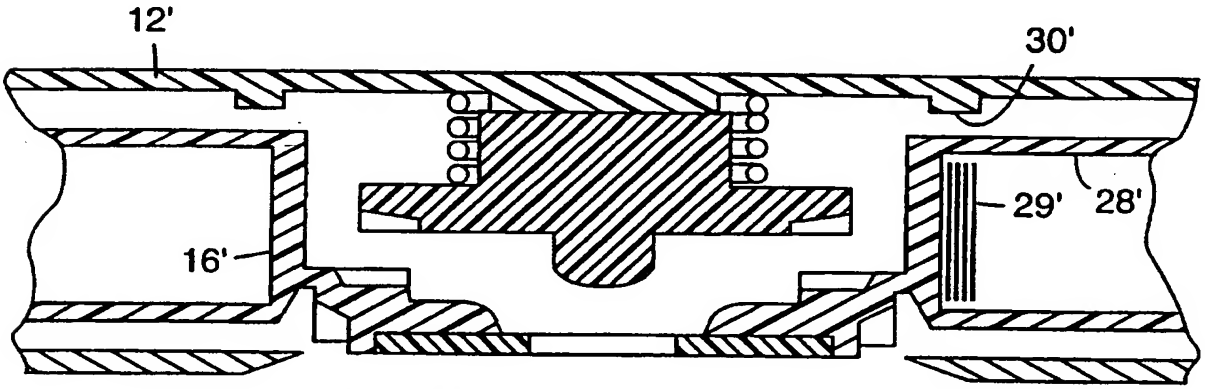


Fig.2

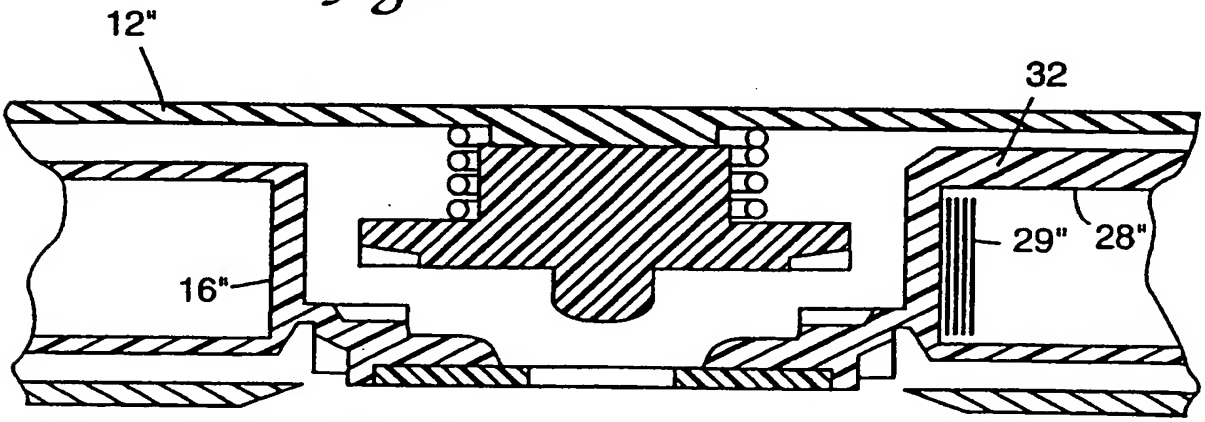


Fig.3

INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/US 96/16434

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G11B23/107

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G11B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP,A,0 588 219 (MINNESOTA MINING & MFG ;STORAGE TECHNOLOGY CORP (US)) 23 March 1994 cited in the application see column 5, line 12 - column 6, line 34	1,7
Y	US,A,3 987 489 (SCHOETTLE KLAUS ET AL) 19 October 1976 see column 4, line 47 - line 64	1,7
A	US,A,3 836 096 (FUKUSHIMA J ET AL) 17 September 1974 see column 5, line 29 - line 64	1
A	US,A,3 857 531 (JANTZEN J) 31 December 1974 see column 3, line 11 - line 17	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 January 1997	28.01.97

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax (+ 31-70) 340-3016	Ressenaar, J-P

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter nal Application No
PCT/US 96/16434

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
EP-A-0588219	23-03-94	CA-A-	2105116	15-03-94
		JP-A-	6282960	07-10-94
US-A-3987489	19-10-76	US-E-	RE29976	24-04-79
US-A-3836096	17-09-74	CA-A-	980317	23-12-75
		DE-A-	2264553	18-04-74
		DE-A-	2264555	02-05-74
		GB-A-	1416744	03-12-75
		GB-A-	1416743	03-12-75
		NL-A,B	7216248	05-06-73
		AU-B-	453571	03-10-74
		AU-A-	4948372	30-05-74
US-A-3857531	31-12-74	NONE		